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IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND OCEANOGRAPHY OF BLOCK ISLAND SOUND

Progress Report - April 1974-November 1974
Contract No. - NAS9-13308

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1. Introduction

This document constitutes the progress report on "In Situ Spectro-radiometric Calibration of EREP Imagery and Oceanography of Block Island Sound" (Skylab EREP Investigation 069/070) for the period April 1974 to November 1974. This research is being conducted under National Aeronautics and Space Administration Contract No. NAS9-13308. The objectives of this investigation are:

(a) To relate radiometric spectra measurements to space-acquired imagery over test sites in Arizona under EREP Task Nos. 701224 and 701269.

(b) To determine the utility of sensor systems for oceanographic studies and the correlation of ground truth acquired in Block Island Sound, New York, with the Skylab data collected under EREP Task Nos. 646609 and 646638.

2. Work Status

Oceanographic Data:

The oceanographic "ground truth" for the Block Island Sound test site was collected on 9 August 1973 and 12 September 1973. Water samples were collected from the water column for salinity, oxygen, pigments, organics, phytoplankton, and particle size analysis by employing research vessels R/V KYMA and R/V BLUE SKIES. Only one of the days coincided with the Skylab overpass, namely 12 September 1973. In the reported period, the acquired oceanographic data, both on the August and September cruises,

have been reduced and completely analyzed.

S190-A Data

Multispectral analyses to determine the utility of S190 imagery for oceanographic studies have been completed in the reporting period. S190-A data over Block Island Sound and the adjacent water masses acquired by Skylab on 12 September 1973 and 21 September 1973 was used to perform the following:

(i) Additive color analysis

(ii) Digital image analysis

Additive color analysis was performed using a multispectral color viewer. The reprocessed S190-A imagery for different water areas was examined. Only the images which showed any significant density differences were used to form multispectral color composites. These color composites were reproduced from the viewer screen for correlation with the oceanographic data.

Digital image analysis was performed by using the S190-A data for 12 September 1973 and 21 September 1973 over Block Island Sound. The imagery was used in negative form as supplied by NASA. By using a System 800 for digital analysis of multispectral imagery, the purpose was to establish the statistical characteristics of the densities as they appear in the selected water masses. In summary, the data was analyzed as follows:

1. The negatives (S190-A imagery) were placed on a light table and scanned by a TV camera.

2. These photographs were thus digitized into 512 x 576 x 256 levels in the log mode. At each x, y location on the data frames, the log of the brightness was assigned a digit between 0 and 255.
3. The video signal of the areas of interest was examined and adjusted so that the darkest spot was slightly greater than 0 and the brightest spot slightly less than 255.
4. The density characteristics of the image were then plotted in a histogram on the log digitizer monitor superimposed on the picture; a histogram was plotted out of the teletype and a color display of the image "sliced" into equal levels was displayed on a color monitor. These color displays were photographed for correlation with the oceanographic data.

Other digital image analysis techniques were also used. For example, red and green bands of 21 September 1973 S190-A imagery over Block Island Sound were log digitized using MARKER, DIGIT, HISTOR, AREA, DISPLY programs. The displayed results were then compared with a linear digitization of the same features. It was found that the linear digitization gave greater water detail than the log. The results of the linear digitization for the Block Island Sound imagery are:presented on the following page. It should be noted that these results are only preliminary results for linear digitization of Skylab imagery comparing the red and green bands. It is intended that a full description of the final results and digital

image analysis techniques will be presented in the final report.

Level	Color	Band	
		Green	Red
0-32	Black	44.28	20.72
33-64	Red	11.44	11.18
65-96	Green	13.14	12.32
97-128	Yellow	11.70	22.82
129-160	Blue	11.68	20.50
161-192	Magenta	5.68	6.42
193-224	Cyan	1.32	3.12
225-255	White	0.68	2.82

For more analysis, different color photos were taken comparing the log and linear results. By manipulating the stored digital images for different bands, color displays were obtained for further image enhancement. The following color displays were photographed off the color monitor screen using the 21 September1973 S190-A imagery over Block Island Sound:

(a) Log (green band) + Log (red band)

(b) Log (green band)

(c) Log (red band)

(d) Linear - $\frac{\text{Red Band + Green Band}}{2}$

(e) Linear (green band)

(f) Linear (red band)

(g) Linear - $\frac{\text{Red band - Green band}}{2}$

Images in the infrared (800-900 nm) band were not used as there were no density differences in the water area due to absorption of the infrared radiation.

Similar analysis, as described above, was performed using the imagery over Willcox Playa, Arizona. In addition, enlargements of additive color composites were made in order to determine the utility of S190-A sensor for geological studies.

S-192 Data

Multispectral scanner data over Block Island Sound test site and Willcox Playa has not been yet received. It is anticipated, according to the latest schedule, that this data will be delivered by the end of December 1974.

S-191 Data

Most of the S191 data over the test sites have been received and a preliminary analysis of this data has begun.